HOT NUCLEI and PHASE TRANSITIONS

V. A. Karnaukhov for FASA collaboration*

Joint Institute for Nuclear Research, Dubna, Russia

The nuclear phase diagram includes the liquid phase, spinodal region of liquid-gas mixture, hadron gas and quark-gluon plasma (QGP). There are two critical temperatures: T_c for the liquid-gas phase transition and Hagedorn temperature T_H related to the quark-gluon plasma. Very exhausting search for the signals of QGP in nucleus-nucleus collisions failed. Note that this phase is very short-lived: after ~10fm/c it is transformed into the nucleonic system. So, QGP is some kind of transition state like a compound nucleus. Study of the nuclear properties inside the spinodal region was more successful. The main tool here is fragmentation process, which is the multibody decay of hot nucleus. The final state is the nuclear fog consisting of droplets (IMF, 2<Z<20) and gas interspersed between fragments. We call it the liquid-fog phase transition. The hot nucleus expands due to thermal pressure, enters the spinodal region, where baryon density is less than normal one, ρ_o, and temperature is below T_c. Figure 1 is obtained by the FASA collaboration (for p+Au collisions at relativistic energy). Two characteristic densities were found: $\rho_{t,}$, which corresponds to the "chemical" freeze-out at the top of fragmentation barrier, and ρ_f, which is related to the "kinetic" freeze-out point, when fragments become free. The values of T_c and the fragment emission time were also measured. The experimental study of hot nuclear system dynamics is in progress now.

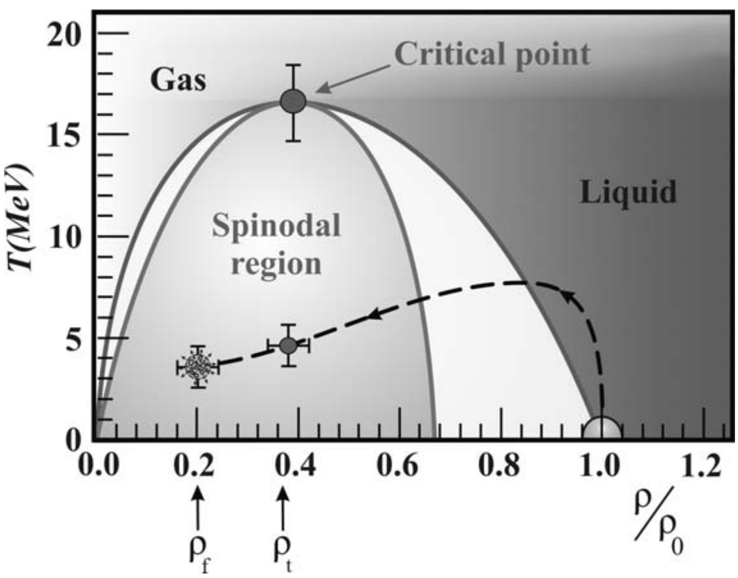

Figure 1.

*| FASA collaboration: S.P. Avdeyev, A.S. Botvina, A. Budzanowski, V.A. Karnaukhov, W. Karcz, V.V. Kirakosyan, E. Norbeck, H. Oeschler, P.A. Rukoyatkin